



INSTRUCTIONS

FORWARD (FREE)-END COVER

GENERAL ELECTRIC DIESEL ENGINES

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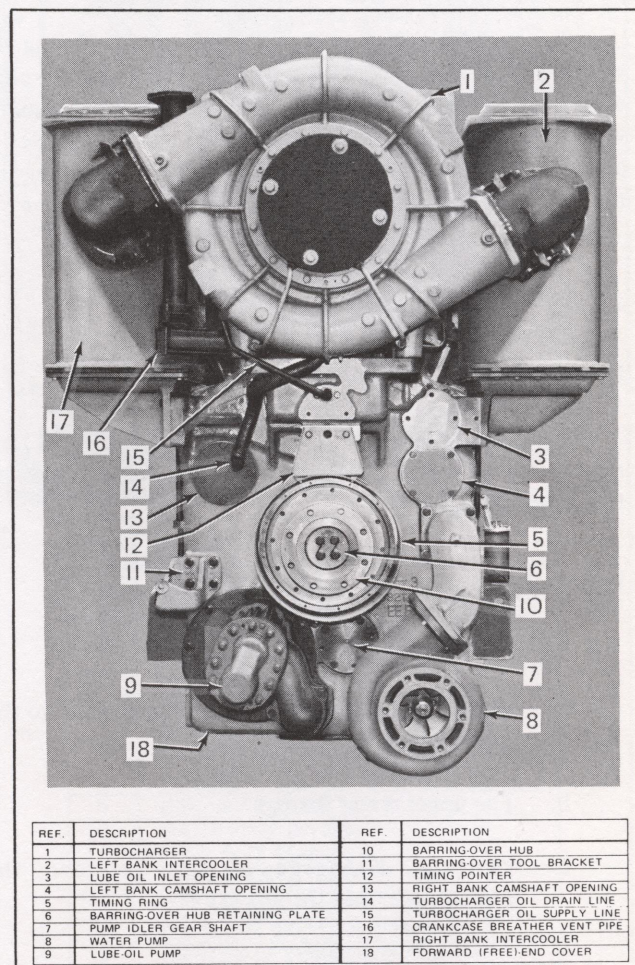
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DESCRIPTION

The engine forward (free)-end cover is a one-piece casting, doweled and bolted to the ends of the main frame and oil pan. It contains water and oil passages and supports certain engine components. See Fig. 1.

Enclosed within the cover are the vibration damper and the gear drive for the lube-oil and water pumps.

On older-production engines, the housing for the cover bearing is located by a rabbet fit and bolted in place. An O-ring seals the housing to the cover to prevent internal oil leakage back to the crankcase. The outer side is sealed by an oil-slinger ring which is machined on the crankshaft and



REF.	DESCRIPTION	REF.	DESCRIPTION
1	TURBOCHARGER	10	BARRING-OVER HUB
2	LEFT BANK INTERCOOLER	11	BARRING-OVER TOOL BRACKET
3	LUBE OIL INLET OPENING	12	TIMING POINTER
4	LEFT BANK CAMSHAFT OPENING	13	RIGHT BANK CAMSHAFT OPENING
5	TIMING RING	14	TURBOCHARGER OIL DRAIN LINE
6	BARRING-OVER HUB RETAINING PLATE	15	TURBOCHARGER OIL SUPPLY LINE
7	PUMP IDLER GEAR SHAFT	16	CRANKCASE BREATHER VENT PIPE
8	WATER PUMP	17	RIGHT BANK INTERCOOLER
9	LUBE OIL PUMP	18	FORWARD (FREE)-END COVER

FIG. 1. EXTERNAL VIEW OF ENGINE FORWARD-END COVER.

runs inside the slinger cavity in the bearing housing, by a lip-type rubber seal at the outer end of the bearing housing, and by a gasket between the housing bolt flange and cover. These were a two-piece assembly consisting of a cast iron housing fitted with a renewable tri-metal bearing.

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

Verify numbers for parts, tools, or material by using the Renewal Parts or Tool Catalogs, or contact your General Electric representative for assistance. Do not order from this publication.

On later-production engines, the housing was replaced by an aluminum alloy casting whose bore was machined to serve as the cover bearing. Except for the integral housing and bearing feature, it retains the fits and other features of the older two-piece assembly.

Late-model engines have the timing marks stamped on the barring-over hub. Older-style engines have a timing ring screwed onto the hub.

Old-style forward-end covers, Part 114X1069-3 (Fig. 4) which are not equipped with a lube oil strainer, have a plug with two O-rings in place of the strainer. On those engines with the old-style cover which do not have a pressure-regulating valve, there is a plug with two O-rings in the left-bank camshaft opening.

REMOVAL FROM ENGINE

REMOVING COVER-MOUNTED PARTS

The lube-oil and water systems must be drained. Then, remove the following cover-mounted parts before removing the forward-end cover:

Intercoolers

1. Disconnect and remove:
 - a. The air-intake manifold sections connected to the intercoolers
 - b. The upper water fittings
 - c. The air discharge elbows between the turbocharger and the intercoolers.
2. With lifting eyebolts installed and the intercooler supported by a crane, remove the mounting bolts and separate the intercooler from the forward-end cover.

Turbocharger

See turbocharger instructions under Tab DE-10.

Water and Lube-oil Pumps

See Tabs DE-12 and DE-13.

Crankcase Breather

See Tab DE-13.

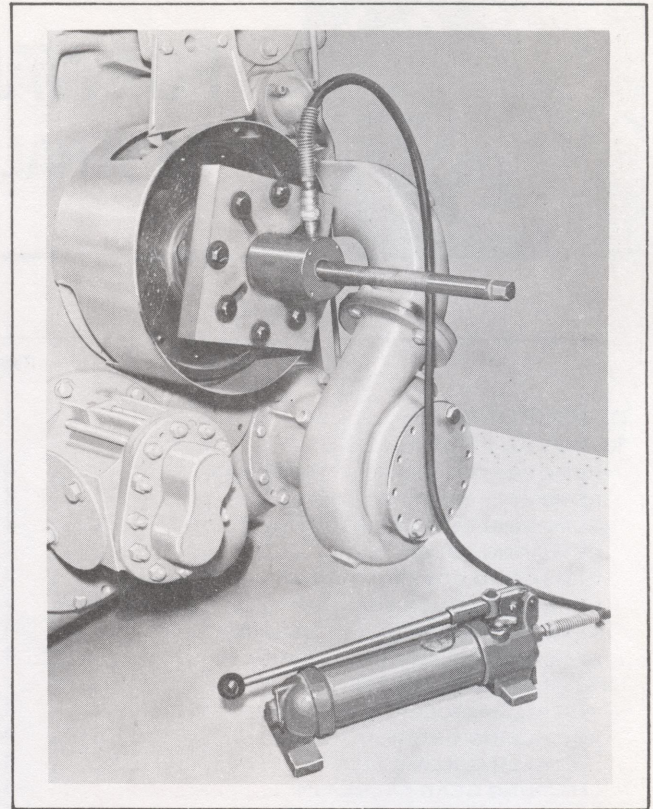


FIG. 2. REMOVING BARRING-OVER HUB WITH PULLER TOOL.

REMOVING BARRING-OVER HUB

1. Remove the engine timing pointer to avoid damage.

NOTE: *Keep pointer with engine from which it was removed. Failure to do so could alter the timing of the engine.*

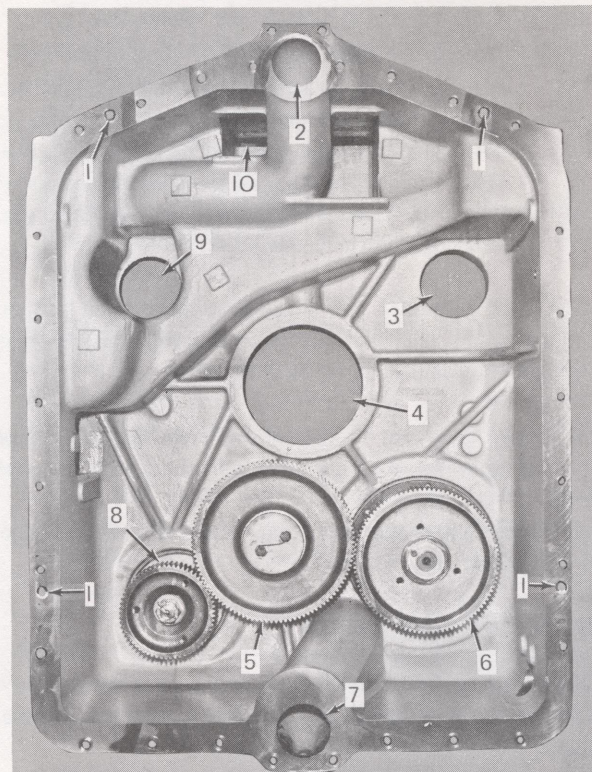
2. Remove the four retaining bolts and the retaining plate from the end of the crankshaft.
3. Apply the puller and remove the hub. See Fig. 2.

REMOVING BEARING HOUSING

Remove the six mounting bolts and remove the barring-over hub guard. Install three 5/8 in.-11 bolts, and jack the housing from the cover.

REMOVING COVER

1. Apply two 1/2 in.-13 eyebolts to the crankcase-breather mounting holes, and attach crane hooks.



REF.	DESCRIPTION
1	DOWEL LOCATIONS
2	LUBE-OIL HEADER SUPPLY PASSAGE
3	RIGHT BANK CAMSHAFT ACCESS OPENING
4	CRANKSHAFT OPENING
5	PUMP IDLER GEAR
6	LUBE-OIL PUMP DRIVE GEAR
7	LUBE-OIL PUMP SUCTION PASSAGE
8	WATER PUMP DRIVE GEAR
9	LEFT BANK CAMSHAFT OPENING
10	CRANKCASE BREATHER OPENING

FIG. 3. ENGINE FORWARD-END COVER, INTERNAL VIEW (NEW STYLE).

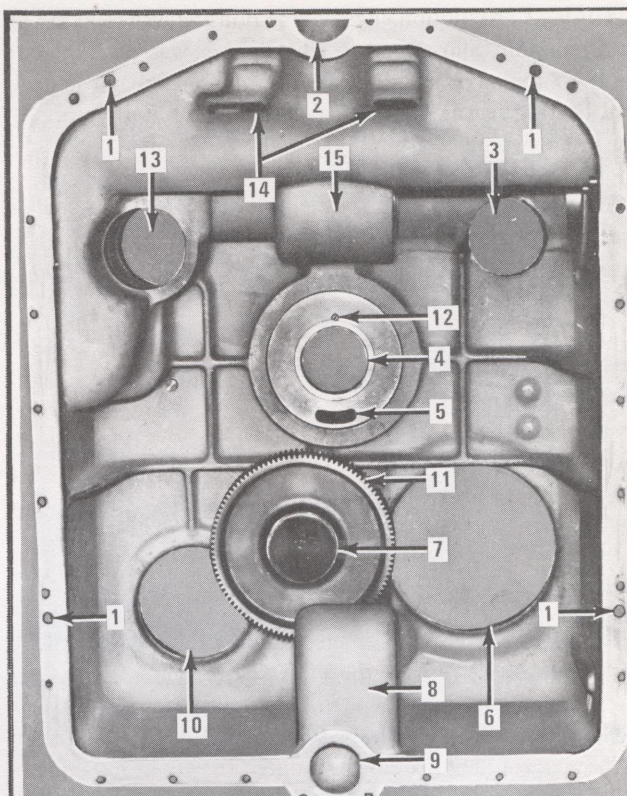
2. Jack out the four internally-threaded dowels (see Fig. 3 and 4).
3. Remove the cover mounting bolts.
4. Pry the cover loose from the frame and remove the cover.

NOTE: Since 1971, covers have four 5/8 in.-11 tapped holes which can be used with jack screws to push the cover loose from the frame and oil pan.

INSPECTING COVER BEARING

Clean the bearing thoroughly and measure the inside diameter. See DATA Section for wear limit.

CAUTION: Do not use a caustic solution on the one-piece aluminum bearing and housing.



REF.	DESCRIPTION
1	DOWEL LOCATIONS
2	LUBE OIL HEADER SUPPLY PASSAGE
3	RIGHT BANK CAMSHAFT ACCESS OPENING
4	COVER BEARING AND OIL RETAINER
5	OIL DRAIN OPENING
6	LUBE OIL PUMP OPENING
7	GEAR RETAINER PLATE
8	INVERTED TRAP IN LUBE OIL PUMP SUCTION PASSAGE
9	LUBE OIL PUMP SUCTION PASSAGE
10	WATER PUMP OPENING
11	PUMP IDLER GEAR INSTALLED
12	COVER BEARING THREADED DOWEL
13	LEFT BANK CAMSHAFT ACCESS OPENING
14	CRANKCASE BREATHER OPENINGS
15	LOCATION OF STRAINER OR PLUG

FIG. 4. ENGINE FORWARD-END COVER, INTERNAL VIEW (OLD STYLE).

RENEWING COVER BEARING (Two-Piece Style)

If the two-piece bearing is worn beyond limits, change it out as follows:

1. Remove the threaded bearing dowel. Place the housing in an arbor press and remove the bearing.
2. Thoroughly clean the housing bore and the new bearing.

*Revisions are indicated by marginal bars.

3. Shrink the new bearing by packing it in dry ice for at least 20 minutes.
4. Quickly insert and correctly position the bearing in the housing.
5. When the bearing is securely in place, drill and tap a new 3/8 in.-16 by 3/4 in. deep dowel hole near the original hole and insert the threaded dowel. Stake the dowel in place.

REMOVING IDLER GEAR AND SHAFT

1. Remove the idler-gear retainer plate bolts and plate.
2. Remove the four gear-shaft bolts at the outer side of the cover.
3. Apply the four jacking bolts, and evenly jack the shaft out until the gear can be removed; then, completely remove the shaft.

RENEWING IDLER-GEAR BUSHINGS

1. Remove the two bearing halves, using a puller tool or hack saw.
2. Clean the gear bore and new bushings. Press the bushings into the gear hub until the thrust collars are properly seated against the gear hub.

INSTALLATION ON ENGINE

INSTALLING IDLER GEAR AND SHAFT

1. Freeze and insert the shaft with a new gasket into its bore, with the oil hole toward the cover top; then, apply the idler gear. On the old-style covers with the inverted trap in the lube-oil suction passage, the idler gear must be positioned before inserting the shaft.
2. Apply the gear retainer plate, with the ground surface facing the gear, and bolt it in place. Lockwire the bolts.
3. Check for proper thrust clearance. See DATA Section.

INSTALLING ORIGINAL COVER

Before applying the cover, make a final inspection to ensure all parts are in good condition, and are properly assembled.

1. a. Completely remove the old cover gasket.
- b. Apply a thin coating of Permatex* No. 3 non-hardening gasket cement to the gasket faces of the frame, oil pan and end cover, and a new cover gasket to the free-end of the engine. Four, long, threaded studs can be used in four of the mounting holes to help hold the gasket in place and position the cover.
2. Check to assure the cover parts have been properly assembled and that the pump idler gear turns freely. Lift the cover as shown in Fig. 4.
3. Apply the cover to the engine, align the dowel holes, and drive the locating dowels in flush with the cover.
4. Apply all cover mounting bolts and tighten them securely.

INSTALLING NEW COVER

These instructions are for mating a forward-end cover (other than the original forward-end cover) to the main frame.

1. Check the dowel holes in the frame to see if oversize dowels will be required to obtain a snug fit in both the frame and the cover. See SUPPLEMENTAL DATA Section.
2. Set the cover in place and bolt it to the frame, tightening the bolts so as to hold the cover in place but permitting the cover to be shifted if needed.
3. If the check made in Step 1 indicates a standard dowel will produce a snug fit in both the frame and the cover, install the dowels. If oversize dowels were indicated, proceed to the next step.
4. Install a dial indicator to the crankshaft, positioned to take readings on the bearing holder bore in the forward-end cover.
5. Rotate the crankshaft, taking readings on the vertical and horizontal centerlines of the bearing holder bore to determine the concentricity of the bore with shaft centerline. See SUPPLEMENTAL DATA specifications.
6. If the readings taken in Step 5 are not to specification, remove the dowels (if installed) and shift the cover to obtain the proper alignment.

*Product of Permatex Co., Inc.

NOTE: The cover may be shifted by using a jack positioned under the cover, or by gently bumping. Care should be taken so as not to damage the cover when shifting.

7. Repeat Step 5.
8. After the proper alignment has been achieved, tighten the end-cover bolts to the value listed in the DATA section.

NOTE: Before proceeding, check the backlash between the pump drive gear on the crankshaft and the pump idler gear on the end cover. Positioning the cover may affect this backlash.

9. Drill and ream holes, as required, using oversize dowels if necessary, to product a snug fit between the dowels and the dowel holes in the end cover and frame

NOTE: Once an end cover has been properly aligned to a particular frame, removal and installation will not affect alignment.

10. Make certain the 1/2 in. pipe tapped hole in the crankcase breather opening in the top of the end cover is fitted with a pipe plug.

CAUTION: Failure to install the pipe plug in the breather cavity will result in excessive oil passing out the stack, possible failure of turbocharger or pump idler gear bearing, or a possible low oil shutdown.

CHECKING GEAR BACKLASH

If the cover has been properly located and all components are in good condition, the pump idler-gear backlash should be correct. The backlash may be measured as shown in Fig. 5. See DATA Section for correct values. Wedge the pump drive gear while measuring the backlash, to avoid faulty readings.

INSTALLING BEARING HOUSING

Two-piece Style

1. Clean the cover bore and the housing.
2. Apply a new O-ring to the housing, with a light coat of lubricant.
3. Apply a new gasket to the flange.

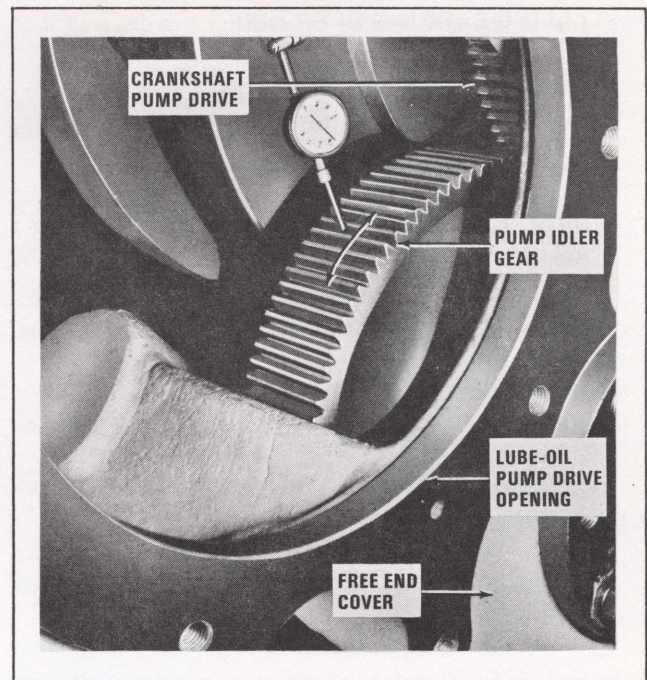


FIG. 5. MEASURING PUMP IDLER-GEAR BACKLASH.

4. Align the locating roll pin and mount the housing to the cover. If no roll pin is present, make sure that the inner drain opening is toward the bottom of the cover.
5. Tap the housing in place, using a soft hammer. Apply the barring-over hub guard, lockwashers, and bolts.
6. Coat the O.D. of the lip-type seal with Permatex No. 3. Lubricate the rest of the seal with engine crankcase oil, and install it in the housing with the lip facing inward.

One-Piece Aluminum Style

1. Clean the cover bore and the housing.
2. Coat the O.D. of the lip-type seal with Permatex No. 3. Preheat the bearing to 200 F (93 C) and press the seal in the housing with the lip facing inward.
3. Perform Steps 2, 3 and 4 as described for the two-piece style.
4. Tap the housing in place, using a soft hammer. Apply the barring-over hub guard, flat washers, lockwashers and bolts.

INSTALLING BARRING-OVER HUB

1. Thoroughly clean the mating parts and inspect for nicks, dents, or burrs. If necessary, dress the surfaces with a fine mill file.
2. Apply the hub. Tap with a soft-face hammer until it is seated on the taper.
3. Mount the hub retaining plate, and torque the bolts to the value listed in the TORQUE VALUES section. Apply a 1/16-in. iron lockwire.
4. Install the engine timing pointer, being sure to locate it accurately with the roll pins.

INSTALLING NEW TIMING POINTER

Each timing pointer is mated with one particular forward-end cover.

When mating a timing pointer (other than the original) to a forward-end cover, proceed as follows:

1. If dowel pins exist in the forward-end cover, shear them off and file smooth. On a new forward-end cover, the pointer must be positioned and new holes must be drilled in the cover for the roll pins.
2. With the No. 1R piston on top dead center and the tram bar (Part 147X1230) in position, adjust the timing pointer so that the right-bank pointer lines up exactly with the:

1 and 8 TDC mark (16-cylinder engine);
1 and 6 TDC mark (12-cylinder engine);
1 and 4 TDC mark (8-cylinder engine).

3. With the pointer in position, drill two new dowel holes 0.125-0.129-in. diameter, 1/2-in. deep. Insert two new 1/8-in. diameter x 3/8-in. roll pins.

INSTALLING COVER-MOUNTED PARTS

Parts which were removed during forward-end cover work may now be reassembled to the engine. Apply new gaskets and O-rings.

DATA

	Min. New		Max. New		Worn Limit	
	In.	mm	In.	mm	In.	mm
Cover bearing						
*Running clearance with crankshaft, diametral	0.007	0,178	0.010	0,254	0.013	0,330
Inside diameter	5.003	127,076	5.004	127,102	5.006	127,152
Interference fit, bearing to housing (two-piece style)	0.001	0,025	0.003	0,076	-	-
Pump idler gear						
*Running clearance with shaft, diametral	0.002 Δ	0,051 Δ	0.005 Δ	0,127 Δ	0.012	0,305
Inside diameter	3.4990 Δ	88,875 Δ	3.5005 Δ	88,913 Δ	3.5075	89,091
Interference fit, bushings to gear	0.0005	0,013	0.004	0,102	-	-
Thrust clearance	0.006	0,152	0.014	0,356	0.030	0,762
Backlash to pump drive gear on crankshaft	0.006	0,152	0.015	0,381	0.040	1,016
Backlash to lube-oil pump gear	0.006	0,152	0.015	0,381	0.040	1,016
Backlash to water pump gear	0.006	0,152	0.015	0,381	0.040	1,016

TORQUE VALUES

Barring-over-hub retaining bolts	80-90 lb.-ft. (108-122 N-m)
Forward-end cover mounting bolts	55-60 lb.-ft. (75-81 N-m)
Pump idler-gear retaining bolts	55-60 lb.-ft. (75-81 N-m)
Jacking-ring mounting bolts	55-60 lb.-ft. (75-81 N-m)
Timing-ring mounting screws (if used)	40-42 lb.-in. (4,52-4,75 N-m)

*Measured with a 1/2 in. (12,7 mm) wide feeler gage.

Δ Using pre-bored bushings, Part 114X1073, which have a 3.5015-3.5025 in. (88,938-88,964 mm) bore, the running clearance could be 0.0045-0.007 in. (0,114-0,178 mm)

SUPPLEMENTAL DATA

Use when mating a forward-end cover (other than the original removed) to a main frame assembly

	Minimum New		Maximum New	
	in.	mm	in.	mm
Diameter, standard dowel	0.7501	19,053	0.7503	19,058
Hole diameter, in end cover and frame, for using standard dowel (after reaming).	0.7492	19,030	0.7502	19,055
Depth, dowel hole in frame	-	-	1.000	25,4
Hole diameter, in end cover, max. allowed	-	-	0.752	19,10
Centerline of bearing-holder bore above centerline of crankshaft	0.0015	0,038	0.0025	0,064
Centerline of bearing-holder bore horizontally off centerline of crankshaft . .	-	-	0.002	0,051

Vertical centerlines of end cover and main frame must coincide within 0.001 in. (0,025 mm) in a 12 in. (305 mm) length.